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(54) Expansion screw for surgical use

(57) A surgical bone screw assembly consists of an outer cylinder (1) and an inner screw (3) which projects from the end of the cylinder (1). An elongate nut (10) is engaged by the screw (3), extends beyond the end (16) of the cylinder (1) and terminates in an enlargement (18) in the form of a nut. A radially expandable plastics sleeve (12) is disposed between the end (16) of the cylinder and the enlargement (18) so that, in use, when the screw (3) is rotated the sleeve (12) is radially expanded to form a large surface contact area for abutting the inner surface (20) of bone cortex.

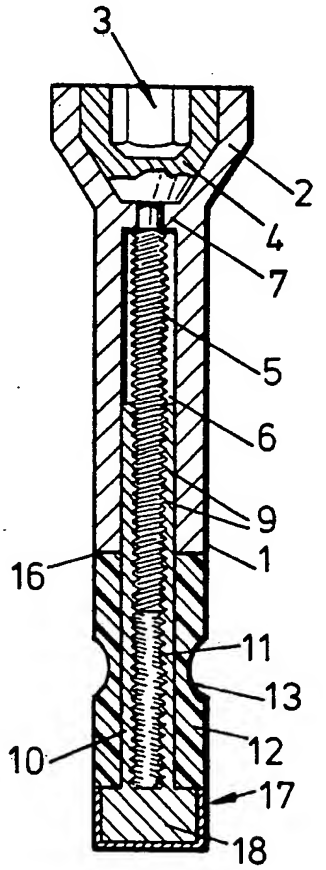

FIG. 1

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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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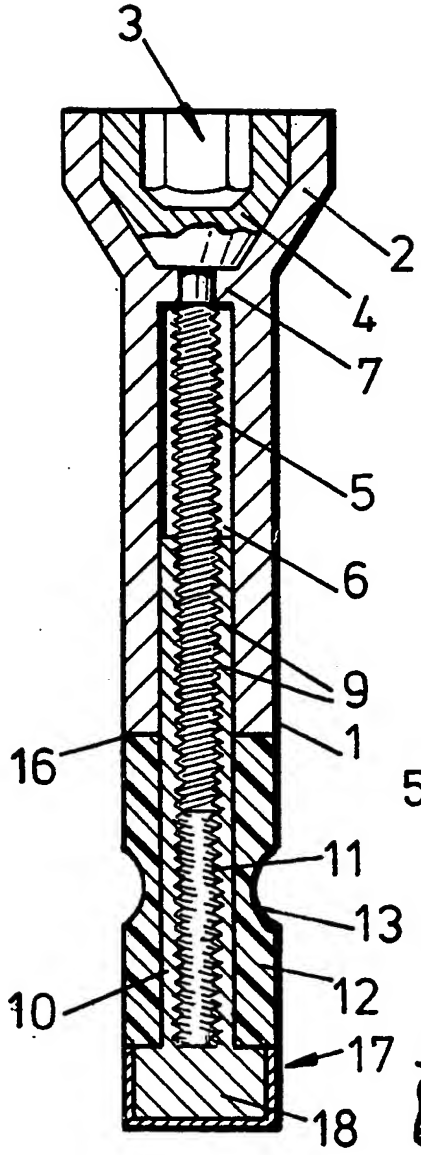

FIG. 1

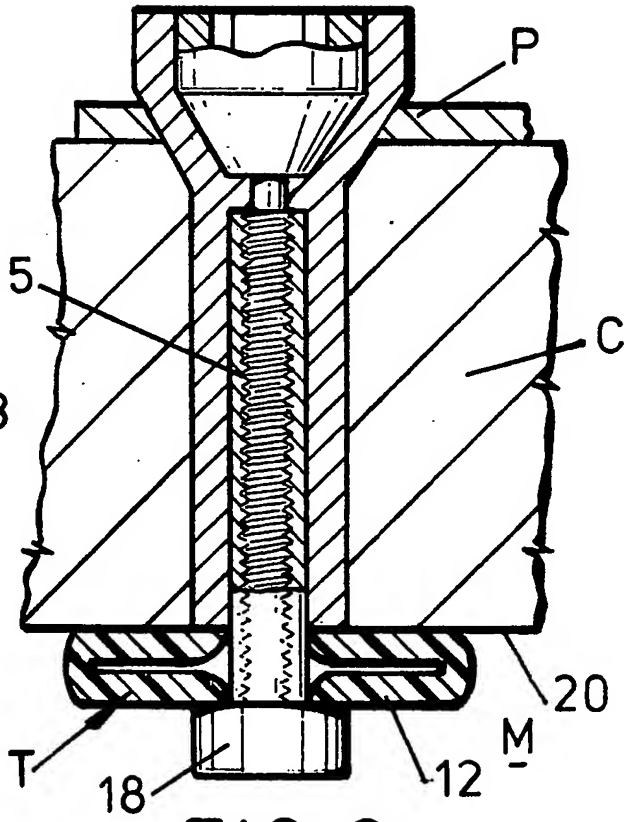

FIG. 2

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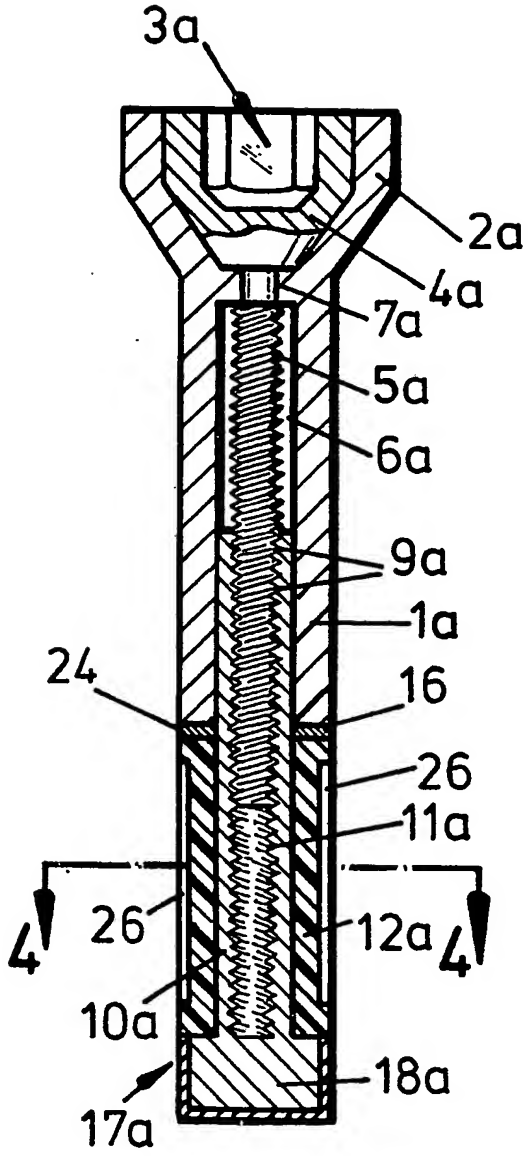

FIG. 3

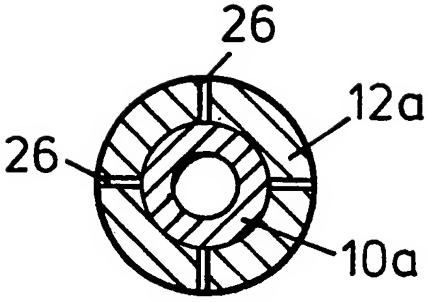

FIG. 4

SPECIFICATION

Screw for surgical use

The invention relates to a screw, especially for surgical use, and has one object to provide an improved surgical screw which is easy to use and of improved efficiency in use.

A screw for surgical use should satisfy a number of desirable criteria in addition to being inexpensive and easy to use in the surgical repair of bones. Although the screws are intended to provide a good clamp between adjacent bones and a plate they should nevertheless permit slight movement of bone so that bone growth is stimulated. In addition, the screws should be readily removed and should minimise the possibility of infection. Furthermore, should infection occur then the action should not cause loosening of the screws in the bones. Also the hole required to be drilled in the bone to receive the screw should not require to be reamed and should permit a much faster operation which is generally beneficial to the patient. In addition, screws should be capable of being used with a single or double cortex.

Typically, surgical screws are threaded and when a hole is drilled into the bone the hole is then reamed to create a thread to receive a threaded screw. This is time consuming, also the grip between the screw and the bone is very tight and, although secure, does not permit slight movement of bone which is necessary to fully stimulate bone growth. Furthermore, if infection occurs at the screw-bone interface, then the attachment can be loosened because the bone around the interface tends to resorb and provide a much less secure connection. In addition, the operation is slow because many such screws are required to give the necessary strength of attachment and generally such screws are passed through a double cortex, that is from one side of the bone to the other and it is not possible to practically use a single cortex. In addition, such screws can be difficult to remove and generally are intended to remain in the patient for a considerable length of time.

An object of the present invention is to provide an improved surgical screw which obviates and mitigates disadvantages associated with the aforementioned prior art screw types.

According to one aspect of the invention there is provided a screw for use in the surgical repair of bones, said screw comprising an outer hollow elongate cylinder, a screw element comprising a screw head and a threaded shank, the threaded shank being present within the outer cylinder and having a portion projecting beyond an end of said hollow elongate cylinder, a portion of the shank within the cylinder being of smaller diameter than the outer cylinder so as to define an annulus therebetween, an elongate threaded nut disposed in the annulus for co-opertion with the threaded shank, said elongate threaded nut projecting beyond the end of said hollow cylinder and having an end shoulder portion of greater diameter, a radially expandable element disposed between the end of the cylinder and said end shoulder portion whereby, in use, rotation of the screw element relative to said outer elongate hollow cylinder forces said end shoulder portion towards said cylinder end to radially expand said radially expanding element to form a bone securing plate.

According to another aspect of the invention there is provided a method of connecting a screw to a bone, the method comprising the steps of:—

a) drilling a hole in the wall of the bone to a depth sufficient to reach the medulla.

b) inserting in the hole a screw as claimed in claim 1 until the radially expandable portion is within the medulla, and

c) rotating the screw to expand the radially expandable portion until that expanded portion abuts the inner surface of the bone wall to resist separation of the screw from the bone.

In order that the invention may be well understood, it will now be described by way of example with reference to the accompanying diagrammatic drawings, in which:

Fig. 1 is a vertical elongate sectional view of an embodiment of a screw of the invention;

Fig. 2 is a similar view showing the screw of Fig. 1 in use;

Fig. 3 is a vertical elongate view of another embodiment of a screw of the invention, and

Fig. 4 is a transverse section along lines 4—4 of Fig. 3.

Reference is first made to Fig. 1 of the drawings and depicts a screw which comprises an outer elongate cylinder 1 formed of stainless steel, about 1mm wall thickness. The cylinder 1 has a flared head 2. The cylinder 1 contains a screw element generally indicated by reference numeral 3 having a screw head 4 and a threaded shank 5. The threaded shank 5 is of smaller diameter than the bore of the cylinder 1 so that an annulus 6 is defined. The cylinder has a restriction 7 through which the threaded shank 5 of the screw passes. The shank 5 has an external thread 9 which projects beyond the lower end 16 of the cylinder 1. An elongate threaded captive nut 10 having an internal thread 11 is present in the annulus 6 and in engagement with the threads 9 of the shank 5.

The lower end 17 of the captive nut 10 comprises an end shoulder portion in the form of a nut 18 beyond the lower end of the cylinder 1, the nut 18 having a diameter substantially equal to that of the outer diameter of the adjacent region of the cylinder 1.

A cylinder 12 of high density plastic is secured as by adhesive or welding to the lower end should portion 18 of the nut 10 and in the condition shown has a diameter substantially equal to that of the cylinder 1. The cylinder has an axial length of about 8mm. The cylinder 12 has a performed waist 13. The lower end of the cylinder 12 is secured to the end should portion or nut 18 at the lower end of the captive nut 10.

Reference is now made to Fig. 2 which depicts an example of the screw, in use, to repair a bone fracture in a limb. Firstly, the surgeon drills a hole in the bone cortex C to reach the medulla M. The hole is not reamed out. A plate P with an aperture is

placed over the fracture until the aperture and drilled holes register and the screw is pushed into the hole, until the cylinder 12 projects beyond the cortex C into the medulla M. The screw 2 is then rotated to draw the nut 10 up the shank 5 and within the annulus 6. This axially compresses the plastic cylinder 12 and causes it to be folded upon itself and to expand radially to the condition shown in Fig. 2 to define a substantially circulate plate T about 2mm thick abutting the inner surface 20 of the bone cortex. In this way, the screw holds the plate P securely to the bone. The flared shape of the outer cylinder avoids crumbling of the underlying bone.

Reference is now made to Fig. 3 in which like numerals denote like parts except that the suffix 'a' is added. In the case the cylinder 12*a* is formed of a material such as SILASTIC (RTM). A washer 24 is disposed between the cylinder 1*a* and the cylinder 12*a*. The cylinder 12*a* has four enclosed slits 26 each stopping short of the end of the cylinder. As best seen in Fig. 4 the slits are arranged at right angles to each other. In use, the screw operates as in the case of the embodiment shown in Figs. 1 and 2, and the washer 24 presents the cylinders 1*a*, 12*a* from rotating with respect to each other.

The screw may be made in sizes of from about 10mm to about 50mm in length. The screw is simple and reliable to use, and may be recovered for re-use. The scrrew also permits minimal bone movement to result in stimulation of bone growth and the operation using such screws is much faster than with conventional screws. Also, holes drilled in bone do not require to be reamed and the screw can be used with a single or double cortex and should infection occur at the screw bone interface the effect on loosening of the screw is minimal.

CLAIMS

1. A screw for use in the surgical repair of bones, said screw comprising an outer hollow elongate cylinder, a screw element comprising a screw head and a threaded shank, the threaded shank being disposed within the outer cylinder and having a portion projecting beyond an end of said hollow elongate cylinder, the portion of the shank within the cylinder being of smaller diameter than the outer cylinder so as to define an annulus therebetween, an elongate threaded nut disposed in the annulus for co-opeation with the threaded shank, said elongate threaded nut projecting beyond the end of said hollow cylinder and having an end shoulder portion of greater diameter, a radially expandable element disposed between the end of the cylinder and said end shoulder portion, whereby, in use, rotation of the screw element relative to said outer elongate hollow cylinder forces said end shoulder portion towards said cylinder end to radially expand said radially expanding element to form a bone securing plate.

2. A screw as claimed in claim 1 wherein the outer diameter of said radially expandable element is substantially the same as the outer diameter of said elongate cylinder.

3. A screw as claimed in claim 1 or claim 2 wherein said radially expandable element has a preformed small diameter waist region.

4. A screw as claimed in any preceding claim wherein said radially expandable element is made of high density plastic.

5. A screw as claimed in any preceding claim wherein said outer elongate cylinder has a flared head portion for receiving said screw head.

6. A screw as claimed in any preceding claim wherein said radially expandable element has a periphery, a plurality of axially extending slits disposed around said periphery, said slits terminating before respective ends of said element.

7. A screw as claimed in claim 6 wherein said radially expandable element has four slits disposed at ninety degrees apart around said periphery.

8. A screw as claimed in claim 6 or 7 wherein a washer is disposed between said screw and the end of said outer hollow elongate cylinder.

9. A screw substantially as hereinbefore decribed with reference to Figs. 1, 2 or Figs. 3, 4 of the accompanying drawings.

10. A method of connecting a screw to a bone, the method comprising the steps of:—

a) drilling a hole in the wall of the bone to a depth sufficient to read the medulla.

b) inserting in the hole a screw as claimed in claim 1 until the radially expandable portion is within the medulla.

c) rotating the screw to expand the radially expandable portion until that expanded portion abuts the inner surface of the bone wall to resist separation of the screw from the bone.

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